Aviation Administration.[4] None of these entities have specific standards for PAES; however, they have blanket categories for vascular disorders that are disqualifying. Because PAES is not specifically listed in any of the medical standards or waiver guides, the best practice would be to obtain recommendations from the granting medical waiver authority.

In this patient's case, he is a trained asset with mild symptoms and he received early intervention for his PAES. His symptoms were completely resolved 4 mo after surgery. He stands an 80–90% chance of his popliteal artery remaining patent 10 yr postoperatively and, if it does start to occlude again, it will be a slow process that will not be suddenly debilitating with symptoms he will recognize in the future. According to the Air Force Medical Standards Directory, PAES is disqualifying for all flying classes but not retention standards,* so no Medical Evaluation Board was needed. The waiver authority required all clinical notes from the Primary Care Manager and the vascular surgeon as well as all studies that were done prior to surgery, the operative report, postoperative notes, and a follow-up lower extremity duplex 3 mo after surgery to demonstrate continued patency of the right popliteal artery. The case was referred to the Aeromedical Consult Service for review, ultimately recommending a 3-yr waiver for continued, unlimited service. For patients requiring a vein graft repair in addition to surgical release, the recommendation would be a 3-yr waiver with repeat arterial duplex and vascular surgery follow-up annually for the first 3 yr postoperatively. If the vessel maintains patency, the follow-ups and waiver may be extended in the future.

Pearson VM. *You're the flight surgeon: popliteal artery entrapment.* Aerosp Med Hum Perform. 2016; 87(1):75–78.

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This article was prepared by Hui Ling Li, D.O., M.P.H.

You are the flight surgeon deployed to an expeditionary medical unit at a U.S. air base located in the Middle East. It is summer and the average temperature ranges from 115°F to 130°F. An Army aviator en route to the United States after a 6-mo deployment in Afghanistan was brought in by his battle buddy for elevated temperature and decreased level of consciousness, concerning for heat stroke. Further history reveals that the patient has been having intermittent fever, chills, headache, body aches, and fatigue for the last several days. His initial vitals include the following: blood pressure 100/60 mmHg, heart rate 140 bpm, respiration 20/min, and oral temperature 105°F. Physical exam reveals a drowsy, muscular white man who is oriented only to person and place when aroused. His skin is warm and flushed without rash, his mucous membranes are dry, and he is tachycardic. The patient has no cough or rhinorrhea, his throat is clear, and his lungs are clear. His neck is supple, and his abdomen is soft and nontender. A rapid diagnostic antigen test is positive for malaria.

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1. Which species of malaria parasite is responsible for the majority of deaths in western travelers to malaria-endemic areas?

A. *Plasmodium falciparum.*
B. *Plasmodium vivax.*
C. *Plasmodium ovale.*
D. *Plasmodium malariae.*
E. *Plasmodium knowlesi.*

ANSWER/DISCUSSION

1. A. There are five main species of malaria parasites that are responsible for human disease transmission: *P. falciparum, P. vivax*, *P. ovale*, *P. malariae,* and *P. knowlesi*.[1] *P. falciparum* and *P. vivax* account for most cases in travelers, while *P. ovale* and *P. malariae* are less prevalent. *P. falciparum* causes the most morbidity and mortality and is commonly found in tropical regions such as sub-Saharan Africa, Southeast Asia, and the western Pacific, and in countries sharing the Amazon rainforest. *P. vivax* is the most prevalent species globally and is found in most of Asia, the eastern Mediterranean, and in the Americas.[1,10] *P. ovale* and *P. malariae* cause a small number of malaria infections. *P. ovale* is found in Africa, Southeast Asia, and the western Pacific, while *P. malariae* shares a geographical distribution similar to *P. falciparum*.[10] *P. knowlesi* is a monkey malaria parasite that can cause severe human disease, found most commonly in Southeast Asia and absent in Africa.[5]

Malaria symptoms usually manifest 7 to 15 d after the infective mosquito bite. Malaria is the most common cause of fever in endemic areas.[1,15] The illness is typically accompanied by the classic paroxysm of fever, a cold stage, and sweats. While fever paroxysms can be a strong indication of malaria infection, initial symptoms may be mild and nonspecific, which can lead to misdiagnosis. Fever pattern can vary from every other day to every 3 d, depending on the species of *Plasmodium* infection.[6] Other symptoms range from headaches, muscle aches, chills, malaise, weakness, nausea, vomiting, abdominal pain, and diarrhea to multiorgan failure and coma, contingent on the type of malaria infection.[1] *P. falciparum* malaria can rapidly progress to severe illness, leading to possible death if not treated within 24 h.[15]

P. vivax and *P. ovale* malaria can remain dormant in the liver as hypnozoites and may relapse months, even years, after exposure. Relapsing malaria requires primaquine therapy for radical cure (eradication of hypnozoites), in addition to therapy for circulating parasites. Those individuals who cannot take primaquine, i.e., individuals with glucose-6-phosphate dehydrogenase (G6PD) deficiency, are monitored for symptoms of malaria relapse.[15] The Armed Forces Health Surveillance Center reported 30 cases of malaria among American troops in 2013; over a third were diagnosed in Afghanistan ($N = 11$) and 6 were linked to Africa. Eight cases were caused by *P. falciparum* and nine cases were caused by *P. vivax*.[2] The major plasmodium species in Afghanistan are *P. vivax* (98%) and *P. falciparum* (2%).[14]

2. Which of the following malaria chemoprophylaxis medications is NOT approved for aircrew use?

A. Chloroquine.
B. Atovaquone/proguanil.
C. Doxycycline.
D. Primaquine.
E. Mefloquine.

ANSWER/DISCUSSION

2. E. Chloroquine, atovaquone/proguanil (Malarone®), and doxycycline are approved for malaria chemoprophylaxis in aircrew. Primaquine is approved for terminal prophylaxis of infections with *P. vivax* and *P. ovale*. Mefloquine is not approved for aircrew use due to potential neuropsychiatric side effects.[9,13] While some side effects do occur, antimalarial chemoprophylaxis medications are generally well tolerated.[1]

Dosage for chloroquine phosphate is 500 mg once a week for chemoprophylaxis, starting 1 to 2 wk before entering a malaria risk area and stopping 4 wk after returning. Chloroquine resistance by *P. falciparum* malaria is prevalent worldwide (except for Central America and some regions of Southwestern Asia), limiting its use considerably.[13] Medication adverse side effects include fatigue, headaches, blurred vision, hearing loss, pruritus, and gastrointestinal symptoms (i.e., nausea, abdominal pain, diarrhea).[7,13] Doxycycline is the preferred drug of choice for aircrew in areas with chloroquine resistance. Atovaquone/proguanil is approved as a second-line agent. Both of these medications should be single dose ground tested (72 h for doxycycline recommended) for potential idiosyncratic reactions prior to operational use.[9,13]

Doxycycline dosage is 100 mg once daily for chemoprophylaxis, starting 1 to 2 d prior to entering the exposure area and continuing for 28 d after departing. To minimize gastrointestinal side effects, doxycycline may be taken with some nondairy food and plenty of fluids or by specifically prescribing doxycycline monohydrate or enteric-coated doxycycline hyclate rather than the generic doxycycline hyclate. Photosensitivity may occur with doxycycline use, particularly in fair-skinned individuals. This can be minimized by avoiding prolonged, direct sun exposure and by using sunscreen.[1,13]

Malarone® dosage is one tablet (250 mg atovaquone/100 mg proguanil) a day for chemoprophylaxis, starting 1 d prior to entering the malaria risk area and continuing for 7 d after departing the risk area. Medication should be taken at the same time each day. This medication is well tolerated and side effects are rare. Adverse side effects may include gastrointestinal (GI) symptoms (i.e., nausea, vomiting, abdominal discomfort) and headache.[1,13]

Dosage for mefloquine is 250 mg once weekly, starting 2 wk prior to exposure and terminating 4 wk after departing the risk area. Mefloquine is the drug of choice for nonaircrew deployed to chloroquine-resistant areas, but requires careful screening for psychiatric disease and cardiac conduction disorder.[1,13] This medication is not approved for aircrew use.[13] Members taking mefloquine should be issued medication cards to carry in case medical attention is required.

Primaquine often is given as presumptive antirelapse therapy after travel to a *P. vivax* or *P. ovale* endemic area and is approved by the Food and Drug Administration (FDA) at 15 mg base (26.3 mg salt) daily for 14 d for this indication. Most practitioners, however, prescribe double this dose in clinical practice due to presumptive antirelapse therapy failures seen in some malaria strains. The Centers for Disease Control and Prevention (CDC) also recommends this higher dose.[8] Possible adverse side effects include interference with accommodation, GI symptoms,

intense pruritus, blood dyscrasias, and methemoglobinemia.[13] This medication is contraindicated in patients with G6PD deficiency, as it can cause severe hemolytic anemia. Individuals' G6PD status must be reviewed and documented prior to receiving primaquine.[13]

3. Chemoprophylaxis should be viewed as the last component of a comprehensive malaria prevention program. Which of the following are primary malaria prevention measures deployed military members/travelers can employ to decrease their risk of contracting malaria?

A. Minimize the exposure of bare skin by covering with proper clothing (sleeves down, pant legs tucked into boots).
B. Use of protective clothing/equipment (i.e., permethrin-treated uniforms/bed nets).
C. Use of 33% time-released N,N-diethyl-meta-toluamide (DEET) on exposed skin.
D. Avoidance of mosquito habitats such as areas of standing water and exposure during peak hours of mosquito activity.
E. All of the above.

ANSWER/DISCUSSION

3. E. Primary malaria prevention consists of personal protective measures that minimize mosquito bites.[1,7] Minimize the exposure of bare skin by providing a barrier with permethrin-treated clothing. Pant legs should be tucked into boots or socks, sleeves should be worn down, and the top button at the neck should be closed. Use repellents on exposed skin, such as DEET. Protective equipment such as permethrin-treated mosquito netting over a cot or mattress is recommended. Avoid known mosquito habitats, such as areas of standing water, and limit outdoor exposure during peak hours of mosquito activity (dusk to dawn).[1,7,10]

Chemoprophylaxis is helpful in preventing malaria infection in endemic regions. However, medical providers should emphasize that insect bite avoidance is most important in preventing not only malaria but also other vector-borne diseases for which no chemoprophylaxis or protective immunization exists. Chemoprophylaxis does not prevent all cases of malaria, but these medications should not be discontinued without consulting a medical provider unless life-threatening side effects occur. The Army aviator in this article stopped taking his doxycycline due to photosensitivity and GI side effects shortly after he entered Afghanistan.

4. Which of the following medications are first-line treatments for nonsevere *P. falciparum* malaria?

A. Chloroquine.
B. Sulfadoxine-pyrimethamine.
C. Quinine.
D. Artemesinin combination therapy (ACT).
E. Primaquine.

ANSWER/DISCUSSION

4. D. There are a number of medications indicated for malaria treatment. Although sulfadoxine-pyrimethamine (Fansidar) or quinine in combination with either doxycycline or clindamycin is used to treat uncomplicated or mild malaria, newer therapies are easier to administer and better tolerated by patients. Where chloroquine resistance is present, ACT has been shown to be clinically superior for uncomplicated mild to moderate malaria. Currently, artemether-lumefantrine (Coartem®) is the only ACT approved by the Food and Drug Administration—careful timing and administration with food are required, as outlined in the package insert. Alternative oral therapies include four atovaquone-proguanil 250-mg/100-mg tablets daily for 3 d or five mefloquine 250-mg tablets in a single dose.[3]

Intravenous artesunate is preferred for complicated or severe malaria infections in the United States, but requires an emergency investigational new drug application from the CDC or public health department. Intravenous quinine is no longer available in the United States; intravenous quinidine may be used, if available, but may cause cardiac dysrhythmias and electrolyte imbalances that typically require care in an intensive care unit setting.[1,3,11] Sources for malaria guidance include major command malaria policy, base public health officers, senior flight surgeons, the National Center for Medical Intelligence, the Deployment Health Clinical Center, and the CDC.[3,9,12,13]

AEROMEDICAL DISPOSITION

When deciding chemoprophylaxis need and appropriate medication to use for aircrew, the following are important considerations: 1) the area where the exposure will occur; 2) the length of time before travel/deployment and the exposure duration; 3) the drug resistance profile of the deployed area; and 4) whether terminal prophylaxis is required.[13] Aircrew diagnosed with malaria infection must be grounded during acute illness due to symptoms and risk of incapacitation. They may return to flying duties after recovery without residual sequelae; waiver is not required. Waiver is also not required for approved malaria chemoprophylaxis medications. Mefloquine is not approved for aircrew use. If an aircrew member takes this medication, he or she must remain on duties not including flying for 4 wk to observe for any neuropsychiatric side effects.[13]

The U.S. Air Force, U.S. Army, U.S. Navy, and the Federal Aviation Administration share similar aeromedical waiver policies regarding malaria. Aircrew with active disease are disqualified for flying duties during the acute illness and may return to flying duties once they have recovered without residual sequelae.[4,9,12,13]

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Erratum

Zhang Y, Li Z, Liu X, Liu F, Jing X, Wu B. *Simulated spaceflight operations under sleep deprivation and confinement.* Aerosp Med Hum Perform. 2015; 86(10):865–874.

The authors of this article recently notified us of an error that was not caught earlier. This error is as follows:

In the abstract, the Results section, the second sentence reads "Moreover, the results showed that the operation time of the manual operation (12.49 ± 1.369 at the 33rd hour, 13.27 ± 2.071 at the 57th hour) and mixed operation (4.88 ± 0.247 at the 33rd hour, 5.15 ± 1.308 at the 57th hour) increased significantly with the increase of waking time." It should read "Moreover, the results showed that the operation time of manual operation (10.67 ± 1.706 at the 9th hour, 13.94 ± 4.261 at the 33rd hour) and mixed operation (4.88 ± 0.247 at the 9th hour, 5.15 ± 1.308 at the 57th hour) increased significantly with the increase of waking time."

The online versions of the article have been corrected: http://www.ingentaconnect.com/content/asma/amhp/2015/00000086/00000010/art00005. We apologize for this error and any inconvenience.